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NEBC MEETING NEWS

March 2001. Vice President Paul Somers introduced the evening's speaker, Dr. David Boufford. David came to his position as Assistant Director of Collections in the Harvard University Herbaria from the Missouri Botanical Garden and Washington University of St. Louis via the Carnegie Museum of Natural History in Pittsburgh. The staff at Harvard has been interested in the flora of the Far East for nearly a century and a half, and David Boufford is no exception. David took his first trip to Japan in 1977, followed by a series of trips to China beginning in 1980, while he was at Carnegie Museum. He currently serves on the editorial committees for the *Flora of China*, *Flora of Japan*, *Flora of Taiwan*, and the *Flora of Korea*. He will also serve for a few more months as the Executive Director of the *Flora of North America* project. He was invited to speak this evening about his most recent work and travels in China. His talk was entitled "Hengduan Mountains, China: Hotspot of biodiversity."

The Hengduan Mountains of southwestern China are one of the world's 25 designated "hotspots" for biodiversity. These hotspots make up less than four percent of the world's land area, but are estimated to harbor more than 40 percent of the world's species. Most of the hotspots are in the tropics, but other designated areas include the Cape Province of South Africa, the California Floristic Province, and the island of Madagascar. The Hengduan Mountain hotspot is one of the few, and the most diverse, in the north temperate zone. This corner of the Tibetan Plateau in eastern Tibet and western Sichuan province supports more than 3500 endemic species of vascular plants. The remarkable diversity of the region was first revealed by the work of Joseph Rock, George Forrest, and various Russian explorers. The area was explored further in the early 1940s by Dr. Shiu Ying Hu of Harvard, the first woman to carry out field work in China, and more recently by Chinese botanists. The geology of the area has almost certainly been a major influence on the biota of the area.

The Qing-Zang Plateau (Qinghai and Xizang in Tibet) began to rise about 45 MYA as several separate landmasses, and eventually the Indian subcontinent, plowed into the southern flank of Asia. The squeezing of the plateau to the southeast has resulted in a series of deep, parallel gorges on the eastern edge of the Himalayan range through which three of the world's great rivers,

the Yangtze, Mekong, and Salween, flow. At one point these rivers are only 70 kilometers from one another. The ridges above these rivers reach 6000 m in places, from 1500 m at the water's edge. Slightly farther to the west are also the Irrawaddy and the Yarlong Zangbo; the latter abruptly changes from an easterly flowing stream in southern Tibet to fall precipitously southward along the front edge of the Himalaya to become the Brahmaputra in India. The Hengduan region is the size of Texas but supports somewhere between 9000 and 12,000 species of vascular plants, representing approximately one-third of the flora of China. David painted a portrait of the Hengduan Mountains with a series of stunning photographs, and against that backdrop took us on a tour of the many and varied habitats of the region.

At 3500–3800 m a boreal forest of spruce, fir, pine, willow, and poplar creates the landscape. The herbaceous flora of these woods and forest edges comprises some of the 1200 orchids of China as well as genera such as *Lilium*, *Arisaema* (40 spp.), and *Aconitum* (100 spp.). *Primula*, *Caltha*, and *Iris* grow in associated wet meadows. The recently discovered *Acanthochlamys bracteata* is rare in dry valleys in this area. Its classification has been puzzling, having first been described in the Amaryllidaceae, then put in the Velloziaceae, and more recently placed in its own family, the Acanthochlamydaceae. Molecular evidence indicates a relationship with Velloziaceae, a family primarily of the southern hemisphere. If this placement is correct, *Acanthochlamys*, or an ancestor, may have been a passenger on the Indian raft as it traveled from the southern hemisphere to its present position. In grazed meadows at slightly higher elevation grow many plants that are distasteful or poisonous to cattle, such as *Stellera chamaejasme* (Thymelaeaceae) and *Podophyllum hexandrum* (Berberidaceae). At around 4000–4200 m alpine meadows support a rich herbaceous flora, including a yellow *Cyananthus* (Campanulaceae) and numerous composites such as *Saussurea* (more than 100 spp.), *Leontopodium* (about 25 spp.), and *Anaphalis* (28 spp.). Also found in these high meadows are more than 100 species of gentians—one-third of all of China's gentians.

At the chilly heights of 4000 m and more, *Rheum alexandrae* (Polygonaceae) creates greenhouse-like temperatures for warming insects amongst the yellow bracts of its inflorescence. If the bracts are removed, pollen does not develop normally. The inflated bracts of several species of *Saussurea*, the calyx of *Przewalskia*

(Solanaceae), and the petals of species of *Lilium* clearly offer the same advantage to developing flowers. David continued the trek through the saddles between mountains and on to the mountain crests at 4600 m. No woody vegetation can stand on the windward slopes, though *Rhododendron* thrives to leeward. The diversity of *Rhododendron* in these mountains is phenomenal: 224 species can be found in these mountains, compared with 24 for all of North America, and 32 for Nepal. Significant hybridization has occurred within the group. Yellow-flowered species can be found in large numbers. Across slopes of shale that are hot in summer, cold in winter, and constantly moving, are found very hairy species of *Phyllophyton*, *Eriophyton*, and *Saussurea* and plants with pale, light-reflective, glabrous leaves, such as in *Corydalis benecincta*. Up on the plateau itself buttercups grow at the edges of wet areas and lakes. These lakes trend from freshwater in the southeast to salty and alkaline in the desert-like interior of the plateau. Many are surrounded by thousands of yellow- or purple-flowered individuals of *Pedicularis*. Images of *Pedicularis* (215 spp. in the Hengduan area) and *Euphrasia* rounded out this most memorable presentation of one of the world's most important botanical regions.

—Don Hudson, Recording Secretary.

April 2001. The Distinguished Speaker for 2001 was Dr. Robert Kral, Professor Emeritus of Biology at Vanderbilt University and Resident Research Associate, Botanical Research Institute of Texas. He spoke on "Biology and Management of Rare Plants in the Southeastern United States." He began his talk with the statement "Let's face it; you're doomed." However, what followed was an opportunity to hear how he became involved in an extensive project on rare plants, what constitutes a rare plant in his view, and details of a few of the over 300 rare plants discussed in his resulting book.

Dr. Kral pointed out that the original Endangered Species Act of 1973 did not include plants. He and other taxonomists were asked to develop a list of plants that was published in 1974 by the Smithsonian Institution. Shortly thereafter, Dr. Nathan Byrd of the U.S. Fish and Wildlife Service asked if he would be interested in evaluating the forest-related rare plant species in the South, an area extending from Virginia to Lake Okeechobee,

Florida, and west to Arkansas, eastern Oklahoma, and eastern Texas. Dr. Kral, who attributes his invitation to become involved to a degree in forest management, started the project in 1975. He began by developing a list of species, checking nomenclature, doing literature searches, and checking collections. He was charged with finding the rare species, developing a list of associated species, describing the habitat in such a way that it would fit into a system of forest types, discussing the impact of forestry management practices on the plants, and making management recommendations. The study, which covered some 322 taxa, was completed in 1983 with the publication of the two-volume *Report on Some Rare, Threatened or Endangered Forest-Related Vascular Plants of the South.* Editing such a work was described as a humbling experience.

An important aspect of Kral's work was to come up with management recommendations, and to do that, it was important to determine why plants were rare. Some species are rare because they have very narrowly defined niches and small population sizes, either because they are initial endemics ("baby species") or are "old species," described as "too much junk in the nucleus." In contrast, some rare species of restricted or specialized habitats are abundant or may even be considered weeds where they are found. Irrespective of the population size, these species are particularly susceptible to loss of habitat. Another group of rare plants are those that were once abundant, but have had their habitat destroyed because the "land they occupy is too valuable." These include plants of prairies and wetlands. Finally, he mentioned threats from exotics. Bob pointed out that continental drift separated many species of plants, but that "Homo saps" were reuniting them. Many of these exotics have wide tolerances and disperse rapidly, so rapidly, that some of the early explorers of North America considered some exotics to be native.

From Dr. Kral's perspective, problems that remain in protecting rare species are not just those associated with instituting recovery programs. It is important for forest and landscape managers to leave the land in a better condition than when they started. In addition, it is important to train young biologists to read the landscape as a way to help preserve biodiversity. He concluded this portion of his talk with some questions. How can trained biologists provide input before management decisions are made? Who

will become involved, and who will pay? What is the role of academic institutions in these issues?

Finally, Dr. Kral illustrated a number of the points he had made with a selection of slides. Plants illustrated included *Hymenocallis coronaria* and *Sagittaria secundifolia* growing in or near rocky, swiftly flowing streams that could be affected by changes in water level and quality. Changes in water level also affect plants of sink-hole ponds such as *Rhexia salicifolia*, *Xyris longisepala*, and *Hypericum lissophloeus*. Some of the plants found around ponds of fluctuating water level, such as *Fimbristylis perpusilla*, are abundant some years but absent others. *Zephyranthes treatiae* and *Lilium iridollae* are plants of wet areas but are maintained by periodic fire that reduces competition from other plants. In contrast, woodland species such as *Silene polypetala*, *Veratrum woodii*, *Trillium pusillum* var. *ozarkanum*, and *T. texanum*, are threatened by removal of the forest canopy. *Trillium texanum* is also threatened by erosion from the conversion of nearby sand-hill forests to pine plantations. Quite a few plants that Bob illustrated were from scrub-lands and old dunes of northern Florida that are threatened by development, including *Nolina brittoniana*, *Dicerandra immaculata*, *Asimina tetramera*, and *Liatris ohlingerae*. Some of the rare plants he mentioned, such as *Carex biltmoreana* and *Eriocaulon koernickianum*, are plants of extreme habitat and limited population size. Others, like *Leavenworthia stylosa* and *Streptanthus squamiformis*, are abundant or even weedy where they occur. A few plants, like *Clematis socialis*, are known from only single sites, while others like the pitcher plants, including *Sarracenia alabamensis*, were more widespread, but are becoming rare because of habitat loss involving drainage and invasive species. Throughout his talk, Bob's love for the region and its landscape became clear as he spoke of "Gardens of Eden" and blackwater streams that make you want to say "thank you."

—KAREN SEARCY, Recording Secretary *pro tempore*.

May 2001. Vice President Paul Somers introduced Dr. Carl W. Grobe of Westfield State College in Westfield, Massachusetts, to speak to the club on "Seaweeds: The Underappreciated model systems." Carl grew up in coastal Maine where his interest in the intertidal ecosystem was nurtured. Undergraduate work at Connecticut College and later studies at the University of California

at Davis cemented his life-long passion for seaweeds. Carl's work has extended from the Darling Center in Walpole, Maine, to the ice-bound shores of Antarctica.

Dr. Grobe prepared the audience with a systematic review of the multicellular, macroscopic marine algae that we think of as seaweeds, including the reds (Rhodophyta), browns (Phaeophyta), and greens (Chlorophyta). Seaweeds provide much of the primary productivity of marine and estuarine ecosystems and provide niches and food for many marine and intertidal organisms. In addition, this group of photosynthetic organisms is playing an increasingly important role as a source of nutrients, vitamins, and raw materials for commerce. Studies of the evolutionary history of the seaweeds have provided insights into the primordial endosymbiotic relationship between photosynthetic bacteria and early phagocytic eukaryotes, which gave rise to photosynthetic eukaryotes and the higher plants. Carl reminded us as well of the specific characteristics of the Chlorophyta as source material for the ultimate emergence of plants on land. Carl thus painted the backdrop for his own studies of the physiology of the seaweeds.

Carl is particularly interested in the life of intertidal organisms, and he has chosen the seaweeds as a model system to investigate such things as the stresses induced by the cycles of immersion and emersion and desiccation and hydration, as well as the daily and seasonal fluctuations of temperature and wave action. Although seaweeds have simplified physiology, their biochemistry nevertheless is identical in many respects to that of higher plants. Thus, seaweeds are ideal candidates in Carl's estimation for studies involving responses to light at all wavelengths and the uptake of nutrients. Carl has studied most recently the interrelationship of nitrogen and light absorption, using the red alga *Porphyra* as his subject. As available nitrogen in the medium increases, photosynthesis (and subsequent growth) increases. In particular, when nitrogen is in short supply, the nitrogen seems to be shunted to the ultraviolet-absorbing pigments, which Carl attributes to a possible mechanism for enhanced protection of the seaweed. Carl has also noted a dose response. A high level of light to nitrogen-deprived thalli is "deadly." Oxygen metabolism in photosynthesizing plants includes a suite of enzymes to protect against free radical damage. Nitrogen-depleted algae see a drop-off of 70–75% activity of catalase and associated enzymes.

In related experiments with *Laminaria saccharina*, a kelp, Carl

has measured decreased photosynthesis when ultraviolet (UV) light levels are increased in the presence of reduced levels of nitrogen. When protection from UV is provided, photosynthesis increases whether or not levels of nitrogen rise. Photosynthesis increases to maximum levels if nitrogen levels increase. Seaweeds examined from deep-water habitats reach plateaus of photosynthesis at lower light levels than does material taken from shallow-water environments. Different populations of *Laminaria* develop tolerances as a function of their exposure to light, especially UV wavelengths.

Carl made a clear and unambiguous case for his chosen group as candidates for model studies of environmental effects on the health of higher plants and for biochemical studies in simplified systems.

—Don Hudson, Recording Secretary.